NORTH DAKOTA

LAWS and RULES

In Regard to

Construction, Inspection, Ventilation and Sanitation of School Buildings

Compiled by Edward Erickson, State School Inspector

PUBLISHED APRIL 1, 1920

Published by the State Department of Public Instruction
MINNIE J. NIELSON, Superintendent

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The Antelope Open Country Consolidated School, Richland County. A first class consolidated school. It is a complete school plant, having a modern school building, teacherage, barn and comfortable busses for transportation.

THE LAW IN REGARD TO CONSTRUCTION OF SCHOOL BUILDINGS AND INSPECTION, VENTILATION AND SANITATION THEREOF.

The state law in regard to construction of school buildings and inspection, ventilation and sanitation thereof is as follows:

§ **1489. Buildings Inspected. Plans and Specifications to be Submitted to Superintendent of Public Instruction.**] No building which is designed to be used, in whole or in part as a public school building, shall be erected until a copy of the plans thereof has been submitted to the state superintendent of public instruction, who for the purposes of carrying out the provisions of this act is hereby designated as inspector of said public school building plans and specifications, by the person causing its erection or by the architect thereof; such plans shall include the method of ventilation provided for, and a copy of the specifications therefor.

§ **1490. Construction of School Houses.**] Such plans and specifications shall show in detail the ventilation, heating and lighting of such building. The state superintendent of public instruction shall not approve any plans for the erection of any school building or addition thereto unless the same shall provide at least twelve square feet of floor space and two hundred cubic feet of air space for each pupil to be accommodated in each study or recitation room therein.

(1) Light shall be admitted from the left or from the left and rear of class rooms and the total light area must, unless strengthened by the use of reflecting lenses be equal to at least 20 per cent of the floor space.

(2) All ceilings shall be at least twelve feet in height.

(3) No such plans shall be approved by him unless provision is made therein for assuring at least 30 cubic feet of pure air every minute per pupil and warmed to maintain an average temperature of 70 degrees F. during the coldest winter weather, and the facilities for exhausting the foul or vitiated air therein shall be positive and independent of atmospheric changes. No tax voted by a district meeting or other competent authority in any such city, village or school district, exceeding the sum of two thousand ($2,000.00) shall be levied by the trustees until the state superintendent of public instruction shall certify that the plans and specifications for the same comply with the provisions of this act. All school houses for which plans and detailed specifications shall be filed and approved, as required by this act, shall have all halls, doors, stairways, seats, passageways and aisles and all lighting and heating appliances and apparatus arranged to facilitate egress in case of fire or accident and to afford the requisite and proper accommodations for public protection in such cases. All exit doors shall open outwardly, and shall if double doors be used, fasten with movable bolts operated simultaneously by one handle from the inner face of the door. No staircase shall be constructed with wider steps in lieu of a platform, but shall be con-

structed with straight runs, changes in direction being made by platform. No doors shall open immediately upon a flight of stairs, but a landing at least the width of the door shall be provided between such stairs and such doorway.

(4) Every public school building shall be kept clean and free from affluvia arising from any drain, privy or nuisance, and shall be provided with sufficient number of proper water closets, earth closets or privies, and shall be ventilated in such a manner that the air shall not become so impure as to be injurious to health.

§ **1491. Toilet Rooms. How Constructed.**] No toilet rooms shall be constructed in any public school building unless same has outside ventilation and windows permitting free access of air and light. The provisions of this act shall be enforced by the state superintendent of public instruction or some person designated by him for that purpose.

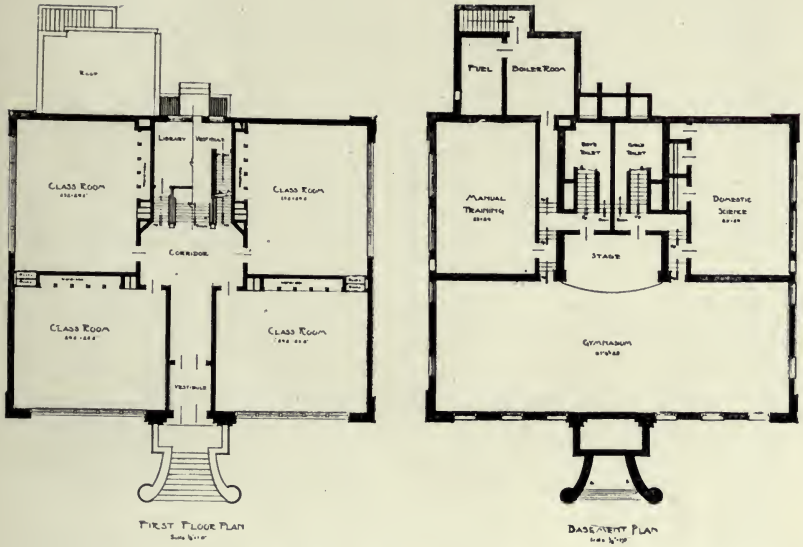
§ **1492. Method of Inspection and Adjustment of Grievances.**] If it appears to the state superintendent of public instruction or his deputy appointed for that particular purpose, that further or different sanitary or ventilating provisions, which can be provided without unreasonable expense, are required in any public school building, he may issue a written order to the proper person or authority, directing such sanitary or ventilating provisions to be provided. A school committee, public officer or person who has charge of any such public school building, who neglects for four weeks to comply with the order of said state superintendent of public instruction or his deputy, shall be punished by a fine of not less than one hundred dollars nor more than one thousand dollars.

(1) Whoever is aggrieved by the order of the state superintendent of public instruction or his deputy issued as above provided, and relating to a public school building, may within thirty days after the service thereof, apply in writing to the board of health of the city, town, incorporated village or school district to set aside or amend the order; and thereupon the board, after notice to all parties interested, shall give a hearing upon such order, and may alter, annul or affirm it.

§**1493. Ventilating Flues and Method of Constructing Same.**] No wooden flue or air duct for heating or ventilating purposes shall be placed in any building which is subject to the provisions of this act, and no pipe for conveying hot air or steam in such building shall be placed or remain within one inch of any wood-work, unless protected by suitable guards or casings of incombustible material.

§ **1494. Approval of Plans. By Whom and Penalty for Violation.**] To secure the approval of plans showing the method or systems of heating and ventilation as provided for in Sec. 1490 the foregoing requirements must be guaranteed in the specifications accompanying the plans. Hereafter erections or constructions of public school buildings by architect or other person who draws plans or specifications or superintends the erection of a public school building, in violation of the provisions of this act, shall be punished by a fine of not less than one hundred dollars nor more than one thousand dollars.

The Coal Harbor Consolidated School



Basement plan and floor plan of Coal Harbor School. A good plan for a four-room school.

INTRODUCTORY STATEMENT

The purpose of this bulletin is to give some definite suggestions as to how the provisions of this law in regard to the heating, ventilation and sanitation of one-room rural, graded and consolidated graded school buildings may be complied with.

This law was enacted several years ago. The law is sound and complies with the generally recognized standard requirements that make for safe, serviceable and sanitary school buildings. The provisions of this law are however, very general and architects and contractors have differed as to ways by means of which the ends sought to be accomplished by the provisions of the law might be complied with.

It is a fact, too, that the rules and regulations prescribed by the Department of Education in regard to heating and ventilation to meet the requirements of standardization and state aid have been too indefinite. These requirements regarding heating and ventilation though complied with have not brought the desired results.

Several hundred school buildings have been erected under the provisions of this law. The heating and ventilation of such a large number of these is so unsatisfactory that the problem of heating and ventilating the one-room, two-to-five room graded and consolidated graded school building is nothing less than serious. This statement is based on three years experience in inspecting these schools in this state. Of the great number of buildings inspected during this period it can scarcely be said that the heating and ventilation in any of the two, three, and four-room buildings is satisfactory—at least where the hot air system is used. The exceptions are very few. The common complaint heard is: "This heating and ventilating system was installed according to the state requirements but we cannot keep the building warm in cold weather." A number of heating plants that were "installed according to state requirements" have been taken out and replaced with a system "installed to heat." With the heating system installed in such a way there is not only no ventilation but no standardization and no state aid.

All school buildings erected in compliance with the provisions of this law meet the requirements for standardization and state aid in regard to building, lighting, heating and ventilation. THERE SEEMS TO BE AN IMPRESSION THAT THE REQUIREMENTS IN REGARD TO HEATING AND VENTILATION NEED NOT BE COMPLIED WITH UNLESS STATE AID IS WANTED. Rather than "taking chances" on a heating and ventilating system that meets requirements for state aid there are some school boards that have preferred to put in a "heating system that will work and let the little state aid go."

Now this "heating system that will work" is usually a system that has an aversion to new unused air. In fact every precaution is taken to keep it out. The old foul used air in the room seems to be considered good enough to be used day in day out for the whole term. If the health of the children is of no consideration then there would be no objection to such a system. But the health of the children is of the greatest import-

ance and therefore every school building to be erected WHETHER STATE AID IS WANTED OR NOT is required to be provided with a heating and ventilating system that complies with the provisions of the law.

HEATING AND VENTILATING OF SCHOOL BUILDINGS.

GENERAL STATEMENT

Heating and ventilation are inseparable so far as the means used for securing a satisfactory temperature and a wholesome supply of air are concerned. The condition so often found, however, a condition due largely to ignorance, is that the devices for securing ventilation are not made use of. Only that part of the plant which warms the room is used. As a result fuel is in some cases saved, in other cases wasted, and in all cases the pupils' comfort is decreased and their energy wasted.

Heat is distributed by air currents only. By cutting off the air currents or reducing them by means of dampers, there is loss not only of ventilation but of heat as well. The jacketed stove not only fails to ventilate but fails absolutely as a heater if the fresh air pipe is not kept open. The foul air pipe or ventiduct must also be kept open all the time in order that the cold, foul air near the floor may be removed. As the temperature of the warm fresh air overhead cools it gradually sinks to the floor and in turn passes out through the ventiduct. By proper operation, therefore, of the jacketed stove, the room is both heated and ventilated. If not properly operated, it does not ventilate, and heats poorly.

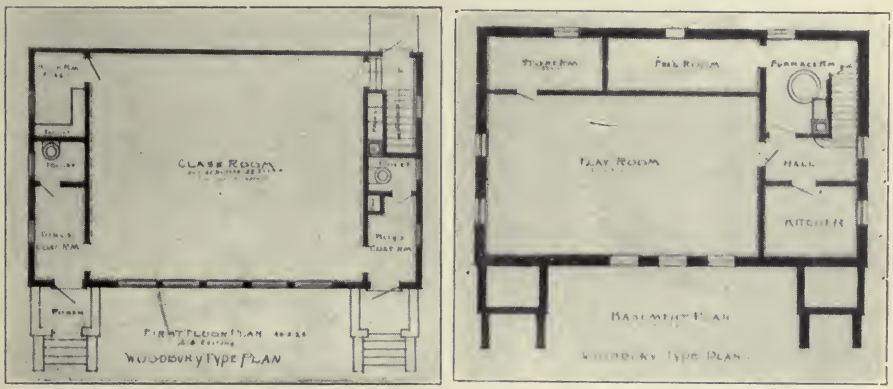
When the warm air basement furnace is used, ducts and openings must be properly placed. From what is known regarding the principles governing the circulation of air, the best results both as to heating and ventilation are obtained when the heated air enters the room about eight feet above the floor, and the air next to the floor is drawn out through a ventiduct on the SAME WALL as the inlet. In this way the air makes a complete circuit of the room before it is discharged through the ventiduct. ONLY AIR FROM OUTDOORS SHOULD BE DRAWN INTO THE FURNACE. The air after it has made the circuit of the room, after it has become polluted by the exhalations from the lungs and the bodies of the pupils should be discharged into the open air from the ventiduct which extends through the roof.

When a steam heating plant is used, the same arrangement of heat flues and ventiducts should be use.

It is frequently urged that there should be a return duct from the school room to the furnace as a means of saving fuel. This arrangement results in some saving of fuel and would be perfectly proper if used only when school is not in session—i. e. in the morning before the pupils arrive. The danger, however, is that once opened, it will be neglected and will allow the air to rotate during the school hours; and it is therefore safer to not provide such an arrangement. Where there already is such an arrangement, teachers and janitors must use it only as intended—i. e. not during school hours.

There seems to be much dissatisfaction expressed over having the warm air inlet high on the wall. The children coming to school become

Woodbury School, Stutsman County



Floor plan and basement plan for the Woodbury School, a very good plan for a one-room school

chilled and have no way to warm themselves. Those who express the dissatisfaction urge that there should be a warm air register in the floor. FLOOR REGISTERS SHOULD NEVER BE PERMITTED IN ANY SCHOOL ROOM.

They allow the air ducts to be filled with dirt and air supplied through such a duct is not fit to breathe. A good way which is frequently used for the children to warm themselves is to provide a seat in the coat room and on the side of the wall under the seat have a warm air register. The warm air streaming out through this will warm their feet. This register being above the floor six or eight inches allows no dirt to collect in it. Another arrangement where the hot air furnace is used is to have two registers in the warm air duct to the schoolroom, one from six to eight inches above the floor and the other about eight feet above the floor. Immediately above the lower register is a damper which when shut allows the warm air to come out through the lower register. This may be used in the mornings when the children want to warm themselves. The upper register is needed and must be used at all times, except as above stated, in order that the heat may be distributed evenly over the room.

We used to think of ventilation as being necessary only to remove air that as a result of having been breathed had had carbon dioxide substituted for a part of the oxygen. Authorities now hold that an accumulation of carbon dioxide in sufficient quantities to make the air dangerous in school buildings is very improbable under ordinary circumstances. The factors which are at present considered essential to good ventilation are: CIRCULATION, TEMPERATURE AND HUMIDITY. These three things are essential in order to secure the greatest amount of human comfort and efficiency. The air must circulate sufficiently to carry off the heat emanating from the body and from the air expelled from the lungs, if not, a feeling of discomfort and indisposition to work results. The temperature must be between 65 and 70 degrees Fahrenheit, and the humidity about 50 per cent. Under these conditions people experience the greatest comfort and the best incentive to work. When cold air is heated the relative humidity is lowered. Some means must, therefore, be found to add moisture to the heated air. For small heating plants, the only means is the evaporating pan. It is therefore essential that this is kept supplied with water at all times.

A heating and ventilating system, therefore, to meet the requirements must furnish a plentiful supply of fresh air at a temperature of from 65 to 70 degrees Fahrenheit. The air must be of the right humidity and it must circulate sufficiently to stir up any quiescent air which may form a casing about the body of the individual. No heating and ventilating plant, however expensive, will do this without intelligent operation.

Where the school district has equipped the school with a heating and ventilating system, it is the duty of the teacher who has the school in charge to learn to operate that plant whether it is a jacketed stove or some other system. The janitor, if there is one, is not as a rule a person who knows very much about the principles governing ventilation or is capable of informing himself in that respect. It is for the teacher to know and see that the system is operated correctly.

VENTILATION

By Dr. J. Grassick

(From Grand Forks County School Bulletin, December, 1917.)

It will not be long before we have to face the rigors of another winter; with it will come problems of vital interest to every one who resides in the northwest. First, of course, come the problems of existence. Homes have to be built, food provided, fuel procured, bodies clothed, feet shod, etc. After these are more or less satisfactorily solved, it is little wonder that some others of seemingly minor importance should be in a manner overlooked. One of the chief of these is ventilation, because it has to do with the health and welfare of the individual. Its importance has not been fully recognized by the masses. Fresh air is the freest of all gifts and by the very reason of this we are apt to overlook its benefits or fail to appreciate its mission in the economy of health. This is especially true in North Dakota, where the severity of the winter weather makes us often feel we are getting too much of a good thing, and we set ourselves resolutely to work to keep it out of our homes. We erect our house with that end in view. We paper and plaster and back plaster and side and double side; we double our doors and windows and felt the joints and stop up every crack or cranny that could by any possibility let in a whiff of God's fresh air. In winter we lock up for the night as nearly as possible in a hermitically sealed box for the purpose of "keeping warm" and having survived, we repeat the process in the summer for the purpose of "keeping cool." In our newest public buildings, school houses, and assembly halls, we are in a majority of cases making adequate provisions for ventilation, but in the ordinary home, even those that are supposed to be up-to-date and modern, very little attention has been paid to this most important part of the construction. The same may be said in regard to school houses, churches, public halls, etc., in villages and country districts. What does this mean? Simply that we fill our lungs with air charged with oxygen, an interchange takes place and we exhale a vile mixture of carbon dioxide ,waste product, effete materials and disease germs. This we do about 100 times every hour. An easy calculation will show you how many times you are breathing and rebreathing the same mixture unless provisions are made for a fresh supply. You would not think of washing in the same water that the family and the guests have used and reused in their ablutions; yet this would be hygenic in comparison with inhaling and reinhaling the poison laden and disease infected atmosphere of an unventilated home. No wonder that thousands of women and children, who are by force of conditions and circumstances compelled to spend most of their time indoors, are being slowly poisoned by close rooms and bad air. Slowly and insidiously the work goes on until impoverished constitutions and enfeebled bodies tell the story. Remember that bad air is always a poison whether found in the sanctified atmosphere of a church, the sacred abode of a home, the hilarious precincts of a ball room or the vitiated surroundings of the slums, and any air becomes bad by being breathed over and over again.

We now believe that the regulation of oxygen and carbon dioxide, important though it is, is not the only factor that enters into the intallment of modern ventilating systems. The idea is gaining ground that the physical condition of the air on the outside of the body has as much to do with the metabolism as the chemical condition of the air that enters our body through the lungs. The body processes are governed through the nervous mechanism, and these are influenced very materially by external stimuli acting reflexly on the central organisms. Tropism, the response of protoplasm in external stimuli and little by little is feeling their effect on improved health and an increased metabolism.

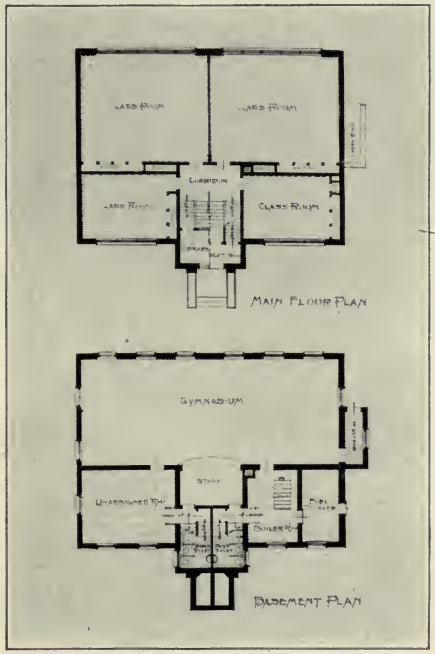
How to get outside air, fresh air, live air, into our homes in our rigid climate and keep up the necessary warmth is a problem that is not easily solved, but it must be solved if we are to get the best that there is out of it. Inside air soon loses its life-giving principle. This biogen, if we may so name it, has so far eluded our search but is there nevertheless. Dead air is deficient in this and may become so by being confined, breathed or passed through some of our modern ventilating devices. It may be an ethereal something that is abstracted by our organism or destroyed by heat or mechanical agitation but whatever it is, we know that it disappears when air is subjected to any of these conditions. Ideal ventilation, therefore, would mean a sufficient and free circulation of outside air through natural conditions. This in our modern dwelling would mean open windows. With zero weather, a stiff gale blowing and fuel on the ascendency, open windows are a luxury that few can afford to have. Under such adverse conditions our modern ventilating systems have a legitimate place. They supply us with air, not by any means the best, but under the conditions we have to face, we must be content with choosing between two evils—breathing of more or less vitiated air on the one hand or being chilled on the other. Subjecting a person in a room to a draft of cold air—even if it is fresh—for any considerable length of time unless the individual is protected sufficiently is hazardous in the extreme. Continued for a short time it may act as a powerful tonic, but the time must be governed by the capacity of the body to react. If beyond this the most serious results may follow. This I believe, is in accordance with plain physiological laws that we often lose sight of in discussing the question.

Get fresh air by the most approved method that you can, but if you cannot have the best, get fresh air anyway.

There is not a purer or better air anywhere than in North Dakota, and yet we find persons closing it out of their homes by every method possible. We are just beginning to wake up to the fact that it is possible to turn every home in our land into a sanitarium where by fresh air and correct methods of living we would not only be able to prevent the development of new cases of consumption but also to combat and cure those already contracted. Let it be emphatically stated here that it is not so much a matter of altitude or climate, but AIR, good fresh air, that is needed, and North Dakota in that respect can give you a quality of material that cannot be surpassed anywhere. These Northwestern breezes that start at

the Pacific coast charged with the iodine of the ocean, kiss in their passage the snow capped peaks of the Rockies, come over the western prairies perfumed with the balm of a thousand flowers in summer and laden with a germ-free breath of healing in winter and bring us a message of health. They calm the unstrung nerves, and tone up the laggard circulation. They give strength to the weak, and the balm of rest to the sleepless. They implant hope in the heart and let the light of truth shine into the soul. Open your homes for them, for in so doing you may be "entertaining angels unawares."

Consolidated School building at Chaseley in Antelope School District, Wells County. This building was erected in 1918 and cost complete with steam heating plant and plumbing $15,100.00.



Floor plan and basement plan of the Chaseley Consolidated School. A good plan for a small four-room building

Consolidated School in Estabrook School District, Foster County. This building is of concrete and hollow clay tile construction with a cement stucco finish. It cost complete with warm air heating plant and toilets $11,700.00 in 1918.

PLANS AND SPECIFICATIONS FOR SCHOOL BUILDINGS

The State Department of Public Instruction has never been prepared to furnish plans and specifications for school buildings. To get plans and specifications it is necessary for school boards to employ an architect. Before adopting plans and specifications prepared by architects or other draughtsmen, these plans must be submitted to the State Department of Public Instruction for approval.

DIMENSIONS OF SCHOOL ROOMS

The most satisfactory dimensions of the ordinary school room have been found to be:

Floor space: For 30 pupils—23 feet by 23 feet 6 inches or 20 feet by 27 feet.

For 35 pupils—23 feet by 27 feet 6 inches or 21 feet by 30 feet.

For 40 pupils—23 feet by 31 feet 4 inches.

There must be not less than twelve (12) square feet of floor space for each pupil.

Ceiling: No school room must be less than twelve (12) feet in height.

Coat room: A coat room must adjoin each school room and must be at least five (5) feet wide. It must have at least one outside window, with a net glass area of one square foot to every ten (10) square feet of floor area.

Doors: Each school room must have a door at least three (3) feet by seven (7) feet, made to swing out, placed preferably near the teacher's end of the room.

BLACKBOARDS

Each school room should have at least one hundred (100) square feet of good blackboard, preferably slate.

The distance of blackboards FROM THE FLOOR should be, for primary rooms, not more than twenty-four (24) inches; for grammar grades, not more than thirty (30) inches, except that the front board used mainly by the teacher may be from thirty (30) to thirty-two (32) inches from the floor. For a one-room rural school where there are pupils of all grades part of the blackboards should be not more than twenty-four (24) inches from the floor and part thirty (30) or thirty-two (32) inches.

The width of the blackboards should not be less than forty-two (42) inches.

LIGHTING

Amount of glass area: The glass area of all elementary rooms, all high school study rooms, recitation rooms, industrial rooms and library rooms must equal 20 per cent of the floor area of the room.

Location of windows: Light shall be admitted from the left or from the left and rear of class rooms.

The building should be so placed that each class room shall receive sunlight during some part of the day. Light from the east is most desirable. Light from the west holds second place. Light from the north as well as from the south should be avoided in school rooms.

COLOR OF WALLS AND CEILING

The color upon the walls of the school room is very important, for color affects the nervous system in a very direct way and the reaction is shown in the temperament and disposition of the persons living within those walls.

All walls should be of a light color, but not white. A light gray, light tan, chrome yellow, or a light olive green are the most hygenic colors for school room walls. Blues are depressing; reds are exciting; heavy or bright greens are irritating. Walls should never be a bright clear color but a tint of a color grayed. The woodwork should be a shade of that same color. It is hard to speak in terms of color for there are good and bad effects in every color, and while the good is always good, the bad is not only bad but positively injurious. Therefore, for safety's sake two colors are recommended—light tan walls with brown wood and neutral gray walls with darker gray finishings. Either of these walls will make a room look clean, large and airy and serve as a beautiful background for pictures. In each case the CEILING should be a lighter tint of the wall's color—with the tan walls, a cream ceiling; with the gray walls, a pearl ceiling.

WINDOW SHADES

When building a new school house never leave the windows without shades any more than leave the walls white. The result will be as injurious to the children as to leave out the heating plant although the effects will not be recognized as soon.

It is an economical necessity that every school building have window shades. Shades are needed to regulate the amount of direct light which comes into the room. Direct sunlight falling upon the open books is very injurious to the eyes. Sunlight falling upon the polished tops of desks or glass doors of book cases is reflected into the eyes of the children and is as bad as direct sunlight. Translucent shades should be used. Opaque window shades should not be used. Care should be taken to have color of shades harmonize with color of the walls. The window shades should be the adjustable kind which may be lowered from the top or raised from the bottom at will, thus making it possible at all times to have a softened light over the room which is restful to the eyes and to the nerves.

HEATING AND VENTILATION

Temperature: All heating plants, including both direct and indirect radiation, must be of sufficient capacity to maintain a uniform temperature of seventy (70) degrees F. at the breathing plane in all school rooms when the outside temperature does not fall below twenty degrees F.

Standard temperature of all school rooms shall not be more than sixty-eight (68) degrees F. In corridors and coat rooms the temperature shall be maintained at not less than sixty (60) degrees F. EACH ROOM SHOULD BE PROVIDED WITH A THERMOMETER.

A system of ventilation shall furnish not less than thirty (30) cubic feet of air per minute for each person that the room will accommodate in accordance with the rules governing seating capacities of rooms.

The capacity of a gravity system of ventilation shall be subject to test in accordance with this provision only when the difference of temperature of the outside air and the air of the school room shall be forty (40) degrees, or more.

THE JACKETED STOVE

(Smith system, Waterbury system, or some similar system.)

The jacketed stove such as put out by the Smith or Waterbury system is an excellent heating and ventilating system. It must be installed according to directions for installing these systems and operated properly. The foul air pipe and fresh air intake pipe must be kept open. If these two pipes are closed the jacketed stove not only fails to ventilate but fails absolutely to heat. It is necessary to have a properly built chimney in order to get the best results from such a system. Install the system according to directions furnished by the company selling the system and operate also according to the directions furnished.

THE HOT AIR BASEMENT FURNACE

Furnace requirements: The law requires that all furnaces and furnace installations must be approved by the State Department of Public Instruction before contracts are let.

The "PIPELESS HOT AIR FURNACE" does NOT meet state requirements for heating and ventilating school buildings and cannot be approved by the State Department of Public Instruction.

If a building of two or three or four rooms is to be heated by the hot air furnace it is recommended that two furnaces be used. A large number of two-room buildings heated by one hot air furnace have been inspected and not one has been found that was heated satisfactorily.

The cut on page 23 illustrates the proper way of installing two hot air furnaces.

Design of furnace: The furnace must be designed to heat an adequate amount of outside air to a degree which will insure a comfortable temperature in school rooms and provide at the same time proper ventilation.

The cross section area between the heating surface and the casing must be of such proportion to the fresh air supply duct that no perceptible resistance is encountered by the air in passing to the hot air leaders.

Grate area: The grate area of furnaces in which soft coal is used as fuel shall not be less than one square foot to every 2500 cubic feet of school room and not less than one square foot to every 3500 cubic feet

of corridors, coat rooms and other rooms not continuously used for recitation or study.

The heating surface in direct contact with the fire or with hot gases in a furnace in which soft coal is used shall be twelve (12) feet for each thousand (1000) cubic feet of school room and twelve (12) square feet for each 1500 cubic feet of other space to be heated in the building.

Fresh air intake: All air to be heated shall be drawn from outside. The fresh air intake shall have a cross section area equivalent to not less than eighty (80) per cent of the cross section area of all warm air ducts.

Warm air ducts: The flues for admitting warm air to any room on the first floor shall have a cross section area of not less than one (1) square foot for every one hundred sixty (160) square feet of floor area in the school room. The warm air ducts for the second floor shall have a cross section area of three-fourths (¾) square foot for every one hundred sixty (160) square feet of floor area.

The hot air register should have its lower edge about eight (8) feet above the floor.

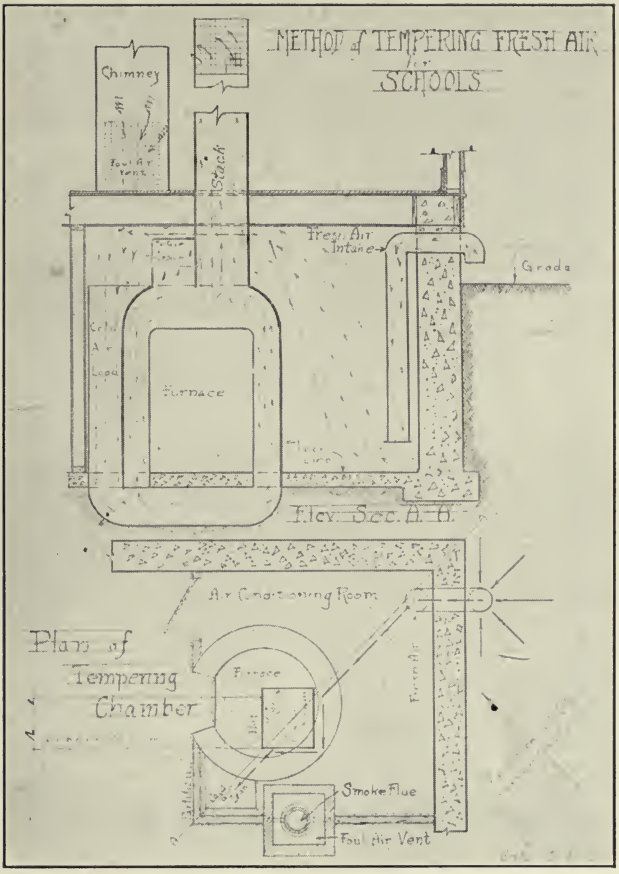
Foul air ducts or ventiducts: As has already been stated before where the hot air furnace is used to heat a two or three room building, two hot air furnaces should be installed. There should also be two chimneys like the chimneys shown on page 27. This is a foul air flue with a clay tile smoke stack in the center. A foul air flue of this kind has been found very satisfactory. A metal smoke stack of No. 12 gauge iron might be used instead of tile but iron will rust out in time.

If separate ventiducts are used then those from the first floor must have a cross section area of not less than three-fourths (¾) square foot for every one hundred sixty (160) square feet of floor area of the school room. The ventiducts from the second floor must have a cross section area of one (1) square foot for every one hundred and sixty (160) square feet of floor area of school room. Vent openings MUST BE at the floor level, on the same side of the room as the warm air flues.

Satisfactory provision must be made for stimulating an upward current in ventiducts. Where the hot air furnace is used this is impossible except by using the chimney with the clay tile smoke stack as the foul air vent.

Where a steam system is used it can be easily accomplished by an accelerating coil. In that case each vent shall have the equivalent of not less than twenty (20) square feet of accelerating coil.

Floor registers: Floor registers MUST NOT be used in any school building, but heat registers in coat rooms may be placed eight (8) inches above the floor. Any heat duct with an opening eight (8) feet above the floor may also have an additional opening near the floor. This lower opening is to be equipped with a register and the heat duct with a damper which will deflect the air current through the register.



This shows a good way of installing a hot air furnace. By means of the fresh air chamber the supply of air is regulated

Foot warmers: Foot warmers if installed will be permitted if register is placed in the wall with edge at floor level. No floor register will be permitted.

Recirculation of air: Return ducts for reheating air should not be used and if used these ducts must not have floor registers. It must be a register in the wall near the floor and on the same wall as the hot air register. The register must be provided with a valve so that the return duct can be closed during school hours.

STEAM HEAT

For buildings of four rooms or more the steam heating system is recommended.

Where the steam heating system is used the heating system shall be combined with the ventilating system, and whenever practicable, the direct radiation and the indirect radiation shall be connected to separate mains.

Where the gravity system of ventilation is used in connection with the steam heating system the heat ducts and vent ducts shall each have a cross section area of not less than one (1) square foot for every one hundred sixty (160) square feet of floor area of the school room.

Heat ducts shall be supplied with not less than fifty (50) square feet of indirect radiation for each square foot of cross section area of duct.

Each ventiduct shall have the equivalent of not less than twenty (20) square feet of accelerating coil.

The fresh air must be taken directly from the outside and should be taken into the fresh air chamber which must be kept clean at all times and must not be used for storage purposes.

All dampers in ventilating systems must have brass tags with an explanation of their use.

FAN SYSTEM OF VENTILATION

For all buildings of six rooms or more the fan system of ventilation should be installed.

THE FURNACE ROOM

Care: Failure to heat a school building properly is often due to the reckless condition in which the basement is kept.

Equipment: The basement should be equipped with storm doors and storm windows and a good coal chute is absolutely necessary.

Coal chutes where built of cement with wooden outside door, should also have an inside door to be kept closed.

In fact all coal chutes should be provided with inside doors. Much coal would thus be saved as those in charge are found to be frequently careless about closing the outside opening.

FIRE PROTECTION

The law regarding fire escapes:

§ **1200. Exits Required.**] All school houses having more than one school room shall have the doors in the exits opening outward, and it is hereby further provided that after the passage of this act school houses

of more than one room thereafter erected shall be provided with an exit not less than four feet six inches in width. All doors to be kept unlocked from 8:30 a. m. to 4:30 o'clock p. m. on school days.

§ **1201. Fire Escape, How Constructed.**] There is hereby required a stationary fire escape, consisting of iron stairways, attached to school houses having more than one story, with iron landings easily accessible from each school room above the first floor, guarded by an iron railing not less than two feet six inches in height. Such landings shall be connected by iron stairs not less than three feet wide and with steps not less than six inches tread, and protected by a well secured hand rail of iron on both sides and reaching to the ground. Provided, however, that the six-foot section immediately above the ground shall be hinged to the main escape so it may be swung out of the way when not in use; further provided that this section shall not affect school houses now constructed and provided with adequate fire escapes. The way of egress to such fire escape shall at all times be kept free and clear from all obstruction of any and every nature.

§ **1202. Duty of School Officers.**] Trustees, boards of directors, boards of education, or any other person having charge of such school houses shall comply with the provisions of this act within six months after its passage and approval.

§1203. Penalty.] Any person or board violating any of the provisions of this act shall upon conviction thereof, be deemed guilty of a misdemeanor and shall be punished by a fine of not less than twenty-five dollars or more than one hundred dollars.

The law regarding fire drill and guards:

FIRE DRILL AND GUARDS FOR PUBLIC SCHOOLS

An Act requiring fire drills in the public schools, providing for fire guards, and prescribing penalties for the violation thereof.

Be it Enacted by the Legislative Assembly of the State of North Dakota:

§1. Duties of Teachers and Superintendents.] It shall be the duty of all teachers in the public schools of this state where any school has more than one room, to give at least two fire drills each month, and no such teacher shall draw his salary for any month until he has certified to the clerk of the school board that such fire drills have been given; provided, that in districts having a superintendent, such superintendent shall prescribe rules governing such fire drills for the schools under his supervision, and he shall not draw his salary until he shall have certified to the clerk of the school board or the secretary of the board of education that at least two such fire drills have been given in each school under his supervision, as provided for in this act.

§2. Duty of County Superintendent.] It shall be the duty of the county superintendent of schools to prescribe reasonable rules for giving fire drills in the rural schools of his county, with special reference to prairie fires, and any school board may direct that no teacher shall draw his salary until one fire drill each month shall have been given.

§3. Fire Guards.] It shall be the duty of every school board in this state to provide such fire guards as they may deem reasonable around schools in their districts. Should any school board fail or neglect to provide such fire guards, it shall be the duty of the county superintendent of schools to notify such school board of such failure, and it shall be a misdemeanor for any member of such school board, after being so notified, to draw his salary until such guards have been made.

SANITATION

County Board of Health law:

§404. County Board of Health. How Composed. (Session Laws 1915.)] There is hereby established county boards of health, composed of a president, vice-president and superintendent; the state's attorney in each county shall be president of the county board; the county superintendent of schools shall be vice-president, and the board of county commissioners shall at the first meeting of the board each year appoint a superintendent of public health for the county, who shall be learned in medicine, and hold a license to practice medicine and surgery within the state, and the several persons appointed shall hold their offices for one year and until their successors are elected and qualified.

Provided, however, that whenever the state board of health has reason to believe that the county superintendent of public health is failing to perform his duties as prescribed by law they may report the case to the board of county commissioners, and the latter may, after proper hearing, at their next meeting declare the office vacant, and appoint another physician in his place for the remainder of the unexpired term.

COUNTY BOARD OF HEALTH HAS AUTHORITY TO CONDEMN SCHOOL BUILDINGS

§1186. County Board of Health.] Whenever the county superintendent of schools shall report to the county board of health that a school house or any school out building is in an unsanitary or unsafe condition, or that any of the pupils or any person of school age is alleged to be defective in mind or body, it shall be the duty of the said board to investigate the report without delay and to direct the school board or a person in charge of the alleged defective to take such action as shall seem to be for the best interests of the persons immediately concerned.

TOILETS

Location: In order to secure convenience of access, adequate light, efficient ventilation, proper care and other sanitary conditions, toilet rooms should be located on the first floor rather than in the basement. This is especially desired in the one room school. All toilet rooms MUST have outside light.

Toilet rooms must not open directly into play room. Boys and girls toilet rooms must be so placed that the strictest privacy is provided.

Fixtures: The number of fixtures cannot be fixed by rule, but in general it may be said that there should be one watercloset for every twenty girls, one watercloset and one urinal for every twenty-five boys.

Inside toilets installed with water pressure system should provide a means of flushing the urinal.

Liquid soap and paper towels should be provided in lavatories. Where outside toilets are built they MUST be built with an entry so as to keep out the snow.

DRINKING FOUNTAINS

In selecting fountains the nozzle should be of a type which will not permit water which has touched the lips to fall back upon the stream from such nozzle.

Common drinking cups and common towels must not be used.

WATER SUPPLY

From "Health Activities in North Dakota Public Schools," by Dr. A. A. Whittemore, Bowman, N. Dak.

The number of schools having no adequate supply of pure water is surprising, and the number of poorly constructed, unclean toilets that are neither weather-tight nor fly-proof is not at all encouraging.

(1.) Water Supply

Without knowing the geological conditions of each county in detail specific information is impossible. In general, however, it is necessary that every school be abundantly supplied with pure water—with bubbling fountains or individual drinking cups, paper towels, and lavatory facilities.

(2.) Dug Wells

This type of well is not usually conceded to be desirable or even safe under most conditions and requires more care than is ever given it. It is always a shallow well invariably becoming contaminated and unsafe from the growth of organic matter at the bottom and along the walls. Gophers, mice and other small animal life soon fall into it. The surface drainage is usually too flat and inadequate and the platform leaky and unsanitary. If in addition to this there is an over-abundant supply of water, no matter how pure its source, the water is sure to become unwholesome, even if the well is cleaned and pumped out once a year, which is, by the way, seldom done.

(3.) Driven, Bored and Drilled Wells

These types of wells when conditions are at all favorable, and pure water can be obtained in sufficient quantities, are the only ones to be seriously considered. Organic bacteria are not usually found in numbers detrimental to health five or six feet below the surface. If these wells are properly curbed with drainage tile or galvanized iron tubbing extending a foot or more above the surface and the catchment area has been carefully inspected to see that the surface drainage is good and that impervious strata do not lead from sources of contamination, the water from these wells ought to be good, if they are properly cared for.

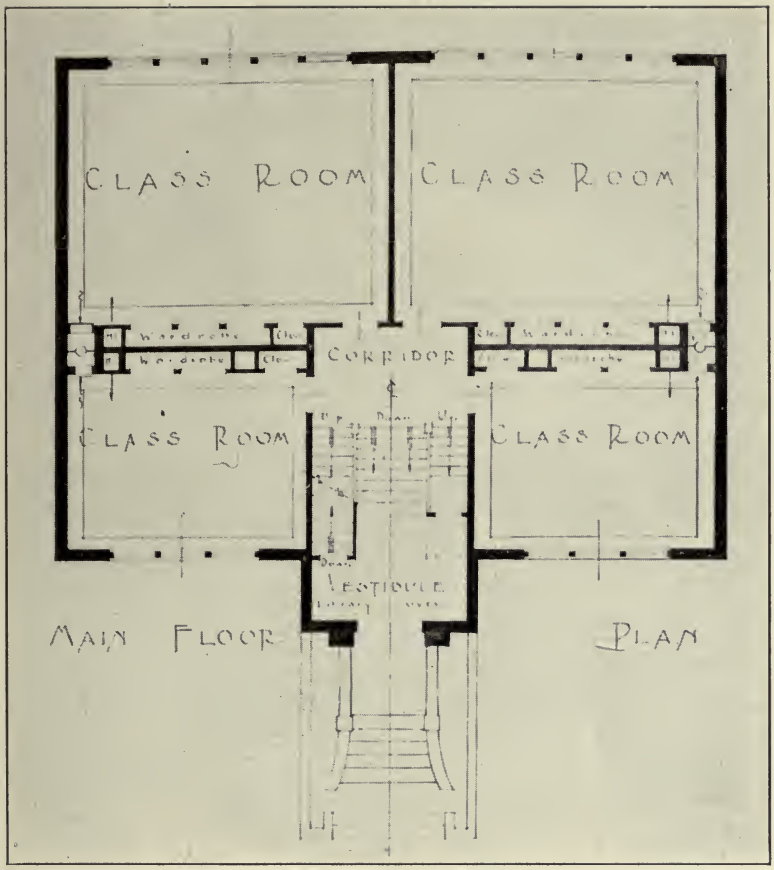
(4.) Cisterns

There are a few places in the state where wells of any description cannot be had. In these places storage tanks or rain water cisterns have to be resorted to.

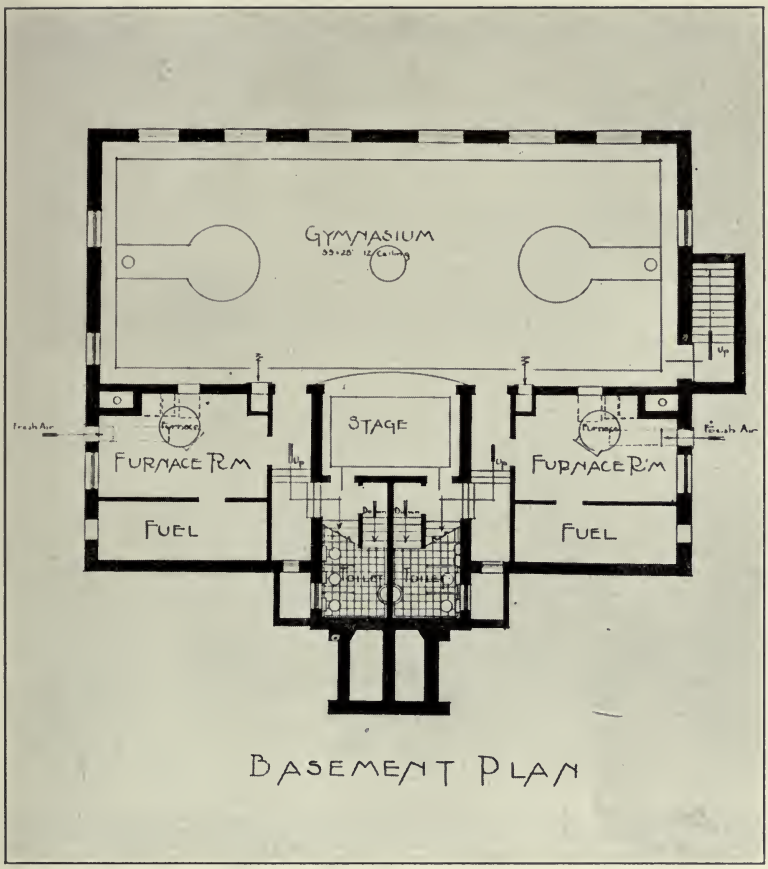
The element of time and sedimentation in stored waters is very much in their favor; but the primary source and mode of transportation should receive careful consideration.

Rain water cisterns may be made safe when the school house is not too closely situated to well traveled roads or to other sources of contamination accessible to flies and birds, and the roof is large enough to supply the demand. The first washings should be discarded. The storage tank in any case may be a simple cistern with well cemented sides, top and bottom, situated in an accessible place. The water should be first run through a coarse sand filter. A soft brick chimney well and tightly laid in cement mortar run up on the inside of the cistern may be constructed for a supply pipe, or the water may be run through either a pressure or a gravity filter. A number of excellent filters are on the market. The whole system may be constructed for $200.00 to $250.00, not much more than the cost of a first class well. The water may be purified if it has bacterial content, by the use of a very small amount of chloride of lime (.016 of an ounce to 1,000 gallons). If you will write to "Health Information Bureau," of the American Public Health Association, Boston, Mass., and tell them your troubles, they will, without cost, inform you where any desired information on any health problem may be found.

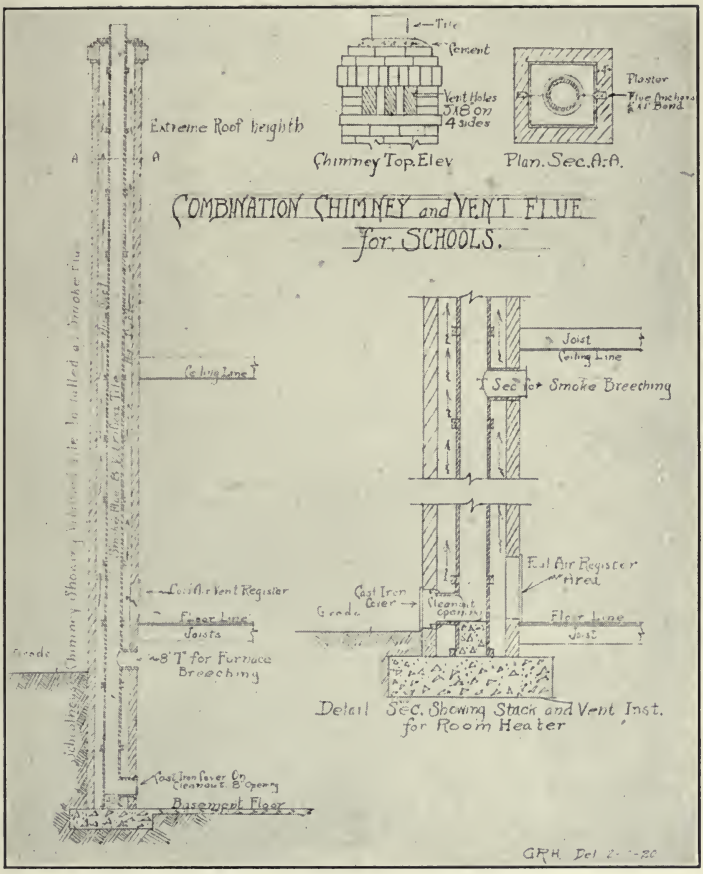
Any water supply whether in wells or in storage systems should be examined bacterially and chemically at one of the State's Health Laboratories frequently, and the report kept on file as a permanent record. Special containers will be furnished upon application to the nearest Public Health Laboratory.



This is an excellent floor and basement plan for a small four-room school. There ar two large class rooms and two small class rooms.



It also shows the proper way to install hot air basement furnaces. There are two furnaces and two chimneys like the one shown on page..... This is the best way of providing good ventilation where the hot air furnace is used. This basement plan with two furnaces and two chimneys is recommended for two-room schools also.



This shows construction of chimney that should be built for all school buildings having hot air basement furnaces or the jacketed stove. It is a combination chimney and foul air vent flue. An 8-inch vitrified tile stack is used as smoke flue. The smoke flue heats the air in the foul air flue giving the air the upward movement and causing the desired draft.